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ABSTRACT

A gender gap between boys and girls has been reported in computer usage. Graphics may play a role in bridging that gap because of their motivational value. The literature reports gender differences regarding graphic content, color, detail, size, and movement. Based on these findings, preliminary design guidelines for graphics in computer-based instructional materials to increase attention and invoke interest of both sexes are proposed. Cross-cultural and age differences need to be examined, and the validity of the preliminary guidelines tested to develop operational guidelines. (Contains 22 references.) (KRN)

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Title:

Different Computer Graphics for Girls and Boys? Preliminary Design Guidelines

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Abstract

Girls and boys may like different kinds of computer graphics. A gender gap favoring boys has been reported in computer usage. Graphics may play a role in bridging that gap because of their motivational value. We give an overview of gender differences reported in the literature regarding graphic content, color, detail, size, and movement. Based on our findings, we propose preliminary design guidelines for graphics in computer-based instructional materials to increase attention and invoke interest of both genders. Cross-cultural and age differences need to be examined and the validity of the preliminary guidelines tested to develop operational guidelines.

In recent years, authors (e.g., Krendl, Broihier, & Fleetwood, 1989; Sutton, 1991) have documented evidence of a gender gap in computer usage. Krendl et al. (1989) reported that various explanations were offered, but most authors agreed the consequences of this gap would increase occupational and economic inequalities between men and women . In a three year longitudinal study they found a strong tendency among boys to respond favorably to computer-based instruction and pursue out-of-school computer activities. In contrast, the girls tended to appear intimidated by the technology and not pursue out-of-school computer activities.

Illustrations play a major role in motivating readers to pick up, browse through, and read books (Duchastel, 1978). Dwyer (1988) reported that visualization in the instructional process increased learner interest, motivation, curiosity, and concentration. Graphics then, may play a similar role in computer-based instruction. Just a little over a decade ago graphics in instructional computer software were restricted by hardware to low resolution (block), monochrome images. Since then rapid advances in the technological capabilities of desktop computers have hurled software developers through numerous advances in screen resolution, color palettes, image processing speed, available memory, and production tools. These advances have resulted in instructional software that often has a heavy visual element. However, little notice has been given to critical issues in the design of computer graphics such as gender differences in children's creation and preferences for graphics and illustrations.

The following review of the literature suggests that boys and girls differ in their creation and preference of certain graphic elements. Freedman (1989) observed that changes in fifth grade girls' images were often subtle, they seemed more concerned than boys with the use of color, whether colors went together, and often discussed relational size and arrangement of shapes . The boys were more concerned with movement and sometimes conceptualized shapes as objects capable of violence.

Jones (1987) found that preschool girls' designs contained greater variety and detail than those of boys, and that girls significantly verbalized more than boys when referring to color selections.

In another study with preschoolers (Calvert, 1989), where computer objects such as animals and vehicles were randomly assigned sounds and actions (animation), boys chose more often action objects than non-action objects while the girls did not.

The computer program Storybook Weaver: World-of-Make-Belief (MECC, 1991), allows users to create stories and illustrate them with professionally prepared art images. The designer of that program, (J. Sharp, personal communication, March 10, 1992), had observed gender differences in stories and graphics children created with the program. She described girls' art as being "friendlier" than boys art, using for example animals and nature images, brighter colors, and daytime scenes. The boys' art was "scarier," night scenes were popular, often with pairs of eyes lurking in the background. Goblins, and sea mammals were prominent among the creatures boys chose to use in their pictures, and clouds, storm, lightning, and fire among other art pieces more characteristic of boys' graphic creations than girls'.

Other studies and observations, although not examining computer graphics, support these findings, revealing considerable gender differences regarding content, color, detail, size, and movement of objects. A description of them follows.

Content

Striking differences have been found in the content of graphics created by elementary school children (Feinburg, 1977; McNiff, 1982). In McNiff's analysis of over 1800 drawings by 26 children, the girls' art was described as quiet and socially-oriented with more people, plants, and animals with the exception of sea animals. The boys' art was more "active" than girls' art and object-oriented with machines, such as cars and motorcycle in chases and races, and conflicts, for example struggles and battles.

Regarding the subjects of conflict and help, Feinburg (1977) found large differences. Conflict for the girls was seen as interpersonal conflict, usually with two friends or relatives in direct confrontation. On the other hand, boys drew structured situations, involving teams, and armies. Portraying helping, personal assistance was dominant for both girls and boys. However, girls' responses were more closely related to family and friends while boys often included rescue and danger.

Gender differences regarding content are not only reflected in graphics but also in written materials. Trepanier-Street and Romatowski (1991) analyzed for example stories by 180 children in grades 1 to 4. They found that characters in stories by girls showed more often pro-social behavior than characters in boys' stories. The opposite was true regarding aggressive behavior. Also, emotional statements were more common in the girls' stories than the boys stories while high risk/adventure themes were more common in boys' stories as well as assignment of high intensity actions to the characters, and a higher percentage of male characters than the girls had in theirs. Similarly, Libby & Aries (1989) analyzed fantasy narratives by 42 preschoolers. They found that girls introduced significantly more female characters and friendly figures who offered assistance while boys introduced significantly more male characters, aggressive behavior and attempts to master situations through the use of aggressive activity. In another recent study by Haynes and Richgels (1992), children in grade four indicated their preference for fictitious annotated book titles. Girls' highest ranked factors included fantasy items and items about growing up and among their other top choices were two historical nonfictions, a social studies item about people in the U.S., and a science item about weather, plants, experiments, and animals. Boys' highest ranked factors included items about adventure, space, science and sports and among other top choices were items about mystery, suspense, and realistic animal fiction. Items that appeared high on the list for both genders were traditional and modern fantasy, realistic fiction, romance, and adjustment, historical fiction, scientific items and biographies.

Findings regarding content imply that peaceful looking graphics with people, plants, and animals tend to be of high appeal to girls, while graphics with figures in actions, vehicles, and implied conflict, danger or suspense tend to be of high appeal to boys.

Color

A color preference study (Child, Hansen, & Hornbeck, 1968), with more than 1,100 students in grades 1 to 12, found that girls consistently preferred lighter colors than the boys did when looking at 35 pairs of colored squares. An exception was the color red. However, Guilford and Smith (1959) did not find a difference in preference for lighter colors. They tested over 200 colors in their study with 40 young adults. However, women in the study gave overall lower ratings for colors than men did.

Results from studies regarding color preferences are not very generalizable. The colors used vary from study to study and the total number of possible colors is huge with differences in the three perceptual dimensions of color: hue; lightness or value; and saturation. Also, numerous other factors affect people's preferences, such as the conditions in the study, current fashion, cultural differences, difference in color perception, and the type of colored materials used. A blue color that most people may find nice on a small "objective" square may not be the first preference for a whole room, or look appetizing in a pasta dish.

Other studies involving color, have found that females have more words to describe colors than males (Lynch & Strauss-Noll, 1987), and female-interest pictures elicited significantly more color reference from both women and men than male-interest and neutral-interest pictures (Crawford & Chaffin, 1987).

Based on these findings it seems that girls may be more interested in colors than boys; but possibly more critical of colors, and whether they go together. Girls may also prefer lighter colors than boys do.

Detail and Size of Objects

Goodenough (1926) developed a popular method to measure children's intellectual maturity. She analyzed and compared drawings of a man by several thousand children of different ages. She found that girls drew more items and with more detail than the boys.

Another finding showed that female college and high school students remembered more detail on photographs in a recall condition than males, especially relating to persons (McGuinness & McLaughlin, 1982).

It seems obvious that details in drawings must be tied closely to content, with increasing detail appearing for subject matters the drawer knows well or has a high interest for. For example, a study done with 6 to 11 year olds found that boys' recall-maps of their home area were richer in detail and more accurate than those of girls of a similar age (Matthews, 1986).

Size is also a variable that may be closely related to content. One study found that girls drew people bigger than do boys (Falchikov, 1990). This may reflect social-orientation and the importance girls seem to place on people in their drawings.

Based on these findings, detail and possibly size of graphic objects of high interest may be appreciated by both genders. At least, this seems to apply to detail and size of people and people-related items of high interest to females.

Movement and Dimension

Consistent gender-differences favoring males have been found in performance on spatial tasks in many studies, summarized for example by Harris (1981).

Goodenough (1926) found that two characteristics of boys' drawings were better sense of proportions than girls, and the inclusion of figures represented in profile as walking or running. The drawings analyzed by McNiff (1982) also showed there was more "action" in boys' art.

Judging from these findings and observations and results reported earlier (Freedman, 1989; Calvert, 1989), we expect items that can be moved, are animated, or at least have implied action associated with them on a still image, to be of high appeal to boys. Three-dimensional looking graphics may also be more appreciated by boys than girls.

Some Preliminary Guidelines for Computer Graphic Design

The findings from our review indicate that creating graphics that appeal to girls, designers should consider:

1. Including pictures of people, plants, and animals. (Based on: Haynes & Richgels, 1992; McNiff, 1982.)
2. Making pictures of people, plants and animals relatively large and detailed. (Based on: Falchikov, 1990; Goodenough, 1926; Jones, 1987; McGuinness & McLaughlin, 1982.)
3. Including a variety of colors, not just primary ones, possibly in lighter shades, or providing opportunity to manipulate color. (Based on: Child, Hansen, & Hornbeck, 1968; Freedman, 1989; Jones, 1987; Lynch & Strauss-Noll, 1987.)
4. Including female characters. (Based on: Libby & Aries, 1989; Trepanier-Street & Romatowski, 1991)
5. Including peaceful, "friendly" scenes. (Based on: Libby & Aries, 1989; McNiff, 1982; Sharp, personal communication, 1992).

Creating graphics that appeal to boys designers should consider:

1. Showing figures in action. (Based on: Feinburg, 1977; Goodenough, 1926; McNiff, 1982.)
2. Providing opportunity to move (or animate) objects. or implying movement of objects (Based on: Calvert, et al., 1989; Freedman, 1989.)
3. Including vehicles. (Based on: McNiff, 1982.)
4. Including male characters. (Based on: Libby & Aries, 1989; Trepanier-Street & Romatowski, 1991.)
5. Including elements of implied suspense/danger. (Based on: Feinburg, 1977; Freedman, 1989; Haynes & Richgels, 1992; McNiff, 1982; Sharp, personal communication, 1992; Trepanier-Street & Romatowski, 1991.)

More research is needed before operational guidelines can be developed. Cross-cultural and age differences need to be examined. The validity of the preliminary guidelines has to be tested. Many questions are unanswered. For example, should a graphic be developed with mixed elements of appeal for both genders, or would that result in graphics that no one liked? Should, instead, separate graphic treatments in the same instructional material be offered or different types of graphics within the same treatment? Can catering to aesthetic preferences in some cases have a negative effect on learning? However, in the past, girls may have been much less considered as an audience for computer software than boys. Using design guidelines like the ones we propose, for graphics in educational software, may help invoke attention and interest of students of both genders.

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